Plant community development after six growing seasons in the two experimental wetland basins

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Introduction

Since 1994, we have been monitoring the plant cover and species richness in the two experimental basins at the Olentangy River Wetland Research Park (ORWRP). In May 1994, Wetland 1 was planted with 2,400 individuals of 13 species of native wetland plants while Wetland 2 was left unplanted as a control (Mitsch et al., 1998). The hypothesis regarding these basins was that "planted and unplanted basin will be similar in function in the beginning, diverge in function during the middle years and ultimately converge in structure and function" (Mitsch et al., 1998).

This paper presents results of aerial and vegetation surveys performed at the ORWRP in September and October 1999, the end of the sixth growing season for these basins. The 1999 data are compared herein to similar vegetation surveys completed during the prior year (Bouchard and Mitsch, 1999). The first three years are summarized by Mitsch et al. (1998). The objective was to determine the spatial patterns of plant communities within the two wetlands and to determine if convergence is occurring or if divergence, as noted in 1998, continues to occur. This study also repeats vegetation transect studies first started in 1997 along the former interior mudflats of the experimental basins.

Methods

Dominant emergent vegetation communities

A black and white aerial photograph taken in September 1999 was used to outline the wetland areas and the dominant vegetation communities for 1999. The photograph was scanned and imported into Adobe Photoshop 5.0. Different grayscale areas were identified and field observations were made in late October to correlate the dominant, though not necessarily exclusive, vegetation communities to each grayscale area.

Transect analysis of emergent macrophytes

Nine transects previously identified in each wetland (Bouchard et al., 1998) along the mudflat gradients (concave section of each wetland basin, starting at the land between the two basins) were analyzed in 1999. Each transect was divided into three zones (Figure 1). These zones, 0, 1 and 2, were initially defined by water depth as found by staff gauge measurements along the mudflat gradient (Weihe and Mitsch, 1996). Zone 0 was closest to open water, Zone 2 closest to the edge of the wetland. Each transect was 2m wide. In areas where the boardwalk intercepted the transects, observations were made in a 1 m on each side of the boardwalk. When possible, observations were made from the boardwalks to reduce the disturbance caused by walking through the vegetation.

In each zone of each transect two areas were observed. First, a full survey, encompassing the entire zone, was made. Second, a square meter survey, inside a 1 m^2 frame randomly placed inside each zone, was made. The square meter survey was done to provide uniformity in the data, as the individual transects and zones are not of uniform length. In each type of survey, the data were recorded using two different scales. The first was the Braun-Blanquet cover scale: (+) limited number of individuals, <5% vegetation cover; (1) plentiful number of individuals, <5% vegetation cover; (2) between 5% and 25% vegetation cover; (3) between 25% and 50% vegetation cover; (4) between 50% and 75% vegetation cover and (5) >75% vegetation cover (Braun-Blanquet, 1932). The second was the US Army Corps of Engineers cover scale: (1) between 0% and 5% vegetation cover, (2) between 5% and 25% vegetation cover, (3) between 25% and 50% vegetation cover, (4) between 50% and 75% vegetation cover, (5) between 75% and 95% vegetation cover and (6) >95% vegetation cover (Environmental Laboratory, 1987).

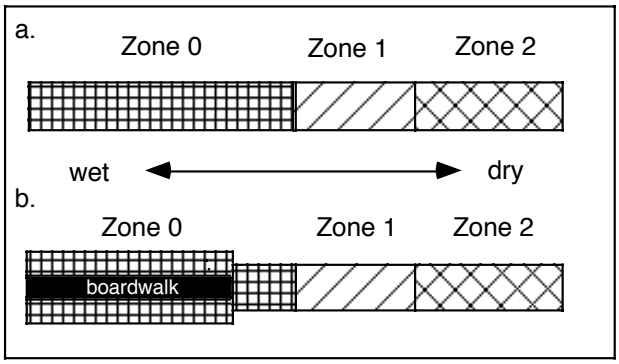

Figure 1. Map of zone in each transect, without (a) and with (b) the intersection of the boardwalk (from Bouchard et al., 1998).

Results and Discussion

Dominant emergent vegetation communities

Counting the edge vegetation, Wetland 1 had approximately 60% vegetation cover and Wetland 2 had an estimated 77% vegetation cover in 1999 (Table 1; Figure 2). These numbers indicate vegetation cover in Wetland 1 similar to 1998 data when there was 63% cover but a general increase in vegetation cover from 71% vegetation cover in Wetland 2 in 1998 (Bouchard and Mitsch, 1999). Since 1994, when there was no vegetation cover, coverage has increased yearly, with Wetland 1 having greater percent coverage than Wetland 2 until 1997, when that trend reversed.

Subsequent analysis of the aerial photograph, leaving out the edge vegetation in the calculation to normalize the 6 years' data, showed that *Typha* dominance increasing dramatically in Wetland 2 since 1996 while it generally remained less that 10% of the vegetation in Wetland 1 (Figure 3). At the end of the growing season, *Typha* was 56.3% of the total area of Wetland 2 while only 8.9% of the total area of the originally planted Wetland 1.

Figure 2 and Table 1 data illustrate another aspect in which the two wetland basins were different in 1999. Five vegetation communities, distinguished by the dominant species, were identified in Wetland 1 while only two were identified in Wetland 2. One of the most significant changes was the decreased coverage by *Schoenoplectus tabernaemontani* in 1999 in both wetlands. In 1998, this species dominated 68% of Wetland 1 vegetation cover and 38% of Wetland 2 vegetation cover. In 1999, the extents were 23% and 8%, respectively. Three communities were present in Wetland 1 that were not in Wetland 2 in 1999; They comprised 38% of the vegetation in Wetland 1. Overall, at 29% of the vegetation cover, the dominant species in Wetland 1 was *Sparganium eurycarpum*, a change from the previous year when *Schoenoplectus tabernaemontani* dominated. *Scirpus fluviatilis* was 6% of the vegetation cover in Wetland 1, a slight decrease from 1998. *Spartina pectinata* accounted for 3% of the dominant vegetation in Wetland 1 and did not appear in the 1998 data as a distinct community; this plant has persisted since the planting on the edge of the wetland and is now forming patches large enough to be seen by aerial photography. *Spartina* increase is likely due to the very dry growing season in 1999 that in turn led to a lower amount of water being added to the experimental wetlands in 1999.

Nelumbo lutea, an aquatic species present in the deepwater areas in 1998, did not reappear as a dominant species in 1999 in Wetland 1. In total, five communities had significant areas of vegetation domination in Wetland 1 whereas in Wetland 2, two communities had this role and one, *Typha* spp., was dominant.

Species Richness

A total of 98 plant species were found in Wetland 1 and 96 in Wetland 2. A list of all species is included in Appendix A. A total of 8 of the original 12 species planted in Wetland 1 are still there and only 2 of those species were found in Wetland 2. Nine species were unique to Wetland 1 while seven were unique to Wetland 2.

Table 1. Coverage (m^2) in each of the experimental wetlands by each dominant vegetation species.

Communitiy	W1	W2
Emergent Vegetation		
Schoenoplectus tab.	1209	507
Scirpus fluviatilis	333	0
Sparganium eurycarpum	1525	0
Spartina pectinata	158	0
Typha sp	526	4941
Edge Vegetation	1560	1244
Total Vegetation Cover	**5311**	**6692**
Open Water	3592	1980
Total Area	**8903**	**8672**

Transect along the mudflat gradient

Analysis of the surveys in each zone gave average species counts for the zones in each wetland (Figure 4). A total list of species seen along these transects in given in Appendix B. Zone 0, the deepest water zone, had the lowest species richness of the three zones, with a trend towards increasing species count with greater distance from the open water. In 1998, Zone 1 was found to have greater, though not significant, species richness than Zone 2 (Bouchard and Mitsch, 1999). The 1999 data indicated that Zone 2 had higher species counts than Zone 1 in both wetlands, although the difference continued to be not significant. Wetland 1 had greater variety in species in Zones 0, slightly fewer in Zone 1 and in Zone 2 the differences were not significant.

Acknowledgments

Daniel Hughes had an equal part in surveying the wetlands and in analyzing the aerial photograph. Transect methods were based on techniques refined by Virginie Bouchard.

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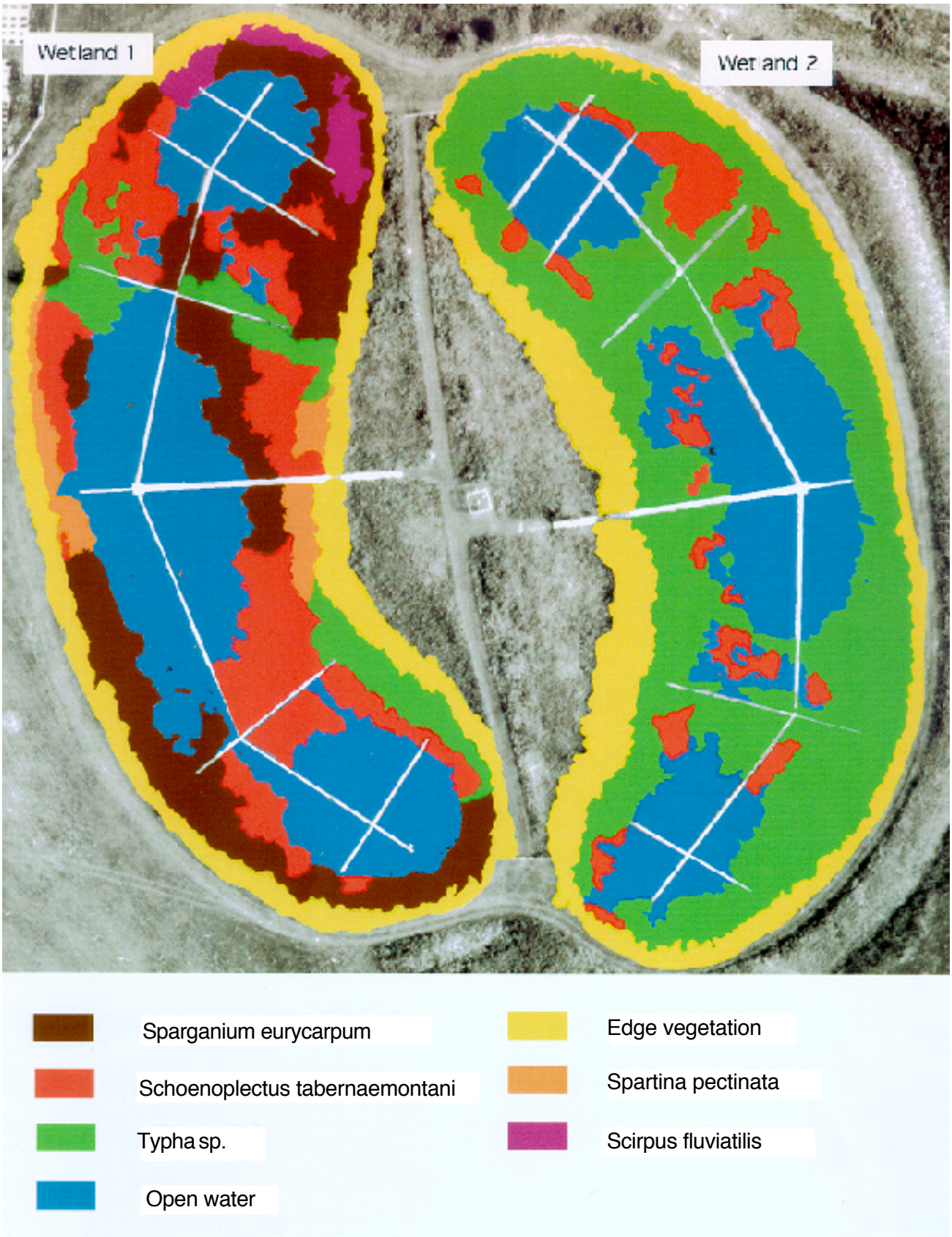

Figure 2. Map of each experimental wetland from September 1999 aerial photography indicating the areas of dominant species vegetation and open water.

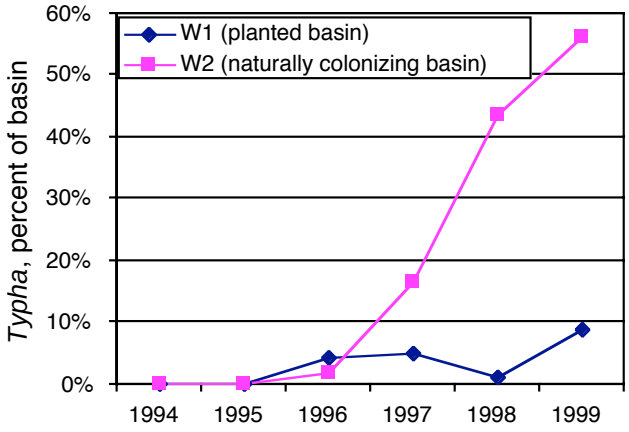

Figure 3. Percentage of *Typha* spp. cover from 1996-99 in the two experimental wetlands.

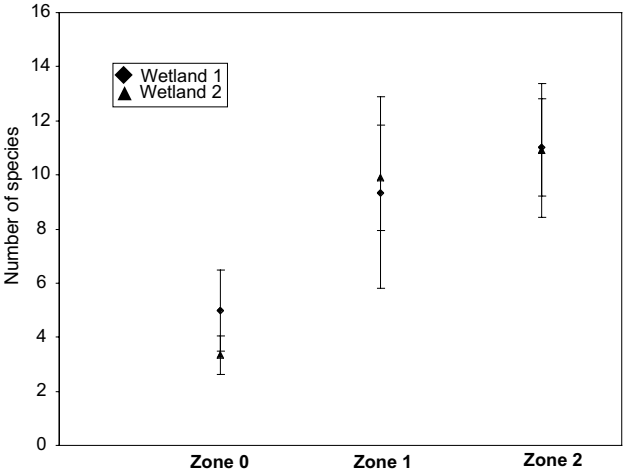

Figure 4. Average number of species found per zone in 1999. Bars indicate standard deviation.

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Appendix A. Vegetation Survey of the two experimental wetlands at the ORW - 29, 30 and 31 August 1999, Bold indicates species originally introduced to Wetland 1 in 1994. P = present; C = common; A = abundant.

Scientific Name	Common name	Indicator	P		C		A		TOTAL		PLANT INTRO		UJIQUE TO WL	
			W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2
Acer negundo	boxelder	FAC	P	P	1	1	0	0	0	0	1	1			0	0
Acer rubrum	red maple	FAC	P	P	1	1	0	0	0	0	1	1			0	0
Acorus calamus	sweet flag	OBL	P	-	1	0	0	0	0	0	**1**	**0**	1	0	1	0
Agrostis tenuis	colonial bent grass	NL	C	A	0	0	1	0	0	1	1	1			0	0
Alisma plantago-aquatica	water plantain	OBL	P	P	1	1	0	0	0	0	1	1			0	0
Ambrosia artemisiifolia	common ragweed	FACU	P	P	1	1	0	0	0	0	1	1			0	0
Amaranthus cruentus	purple amaranth	NL	P	C	1	0	0	1	0	0	1	1			0	0
Apocynum cannabinum	indian hemp	FACU	C	C	0	0	1	1	0	0	1	1			0	0
Asclepia incarnata	swamp milkweed	OBL	C	P	0	1	1	0	0	0	1	1			0	0
Asclepia syricea	common milkweed	NL	P	P	0	0	0	0	0	0	0	0			0	0
Aster sp.	heath aster	FACU	C	C	0	0	1	1	0	0	1	1			0	0
Aster novae-angliae	new england aster	FACW	-	P	0	1	0	0	0	0	0	1			0	1
Aster simplex	panicled aster	FACW	P	P	1	1	0	0	0	0	1	1			0	0
Bidens cernua	nodding bur marigold	OBL	P	C	1	0	0	1	0	0	1	1			0	0
Bidens connata	swamp beggar ticks	FACW	P	P	1	1	0	0	0	0	1	1			0	0
Bidens frondosa	beggar ticks	FACW	A	A	0	0	0	0	1	1	1	1			0	0
Bidens laevis	bur marigold	OBL	P	C	1	0	0	1	0	0	1	1			0	0
Boehmeria cylindrica	false nettle	FACW	P	-	1	0	0	0	0	0	1	0			1	0
Carex tribuloides	blunt broom sedge	FACW	P	P	1	1	0	0	0	0	1	1			0	0
Carex vulpinoidea	fox sedge	OBL	P	P	1	1	0	0	0	0	1	1			0	0
Cirsium altissimum	tall thistle	NL	P	P	1	1	0	0	0	0	1	1			0	0
Convolvulus sepium	hedge bindweed	NL	P	P	1	1	0	0	0	0	1	1			0	0
Cyperus esculentus	yellow nutsedge	FACW	P	P	1	1	0	0	0	0	1	1			0	0
Cyperus strigosus	umbrella sedge	FACW	P	C	1	0	0	1	0	0	1	1			0	0
Daucus carota	wild carrot	NL	C	C	0	0	1	1	0	0	1	1			0	0
Echinochloa crusgalli	barnyard grass	FACU	P	P	1	1	0	0	0	0	1	1			0	0
Eleocharis obtusa	blunt spikerush	OBL	P	P	1	1	0	0	0	0	1	1			0	0
Elymus sp.			P	P	1	1	0	0	0	0	1	1			0	0
Epilobium coloratum	purple-leaved willow herb	OBL	P	P	1	1	0	0	0	0	1	1			0	0
Erigeron canadensis	horseweed	NL	P	P	1	1	0	0	0	0	1	1			0	0
Eupatorium perfoliatum	common boneset	FACW	P	-	1	0	0	0	0	0	1	0			1	0
Eupatorium serotinum	white snake root	FAC	P	P	1	1	0	0	0	0	1	1			0	0
Euphorbia nutans	eyebane broomspurge	FACU	-	P	0	1	0	0	0	0	0	1			0	1
Fraxinus pensylvanica	green ash	FACW	P	P	1	1	0	0	0	0	1	1			0	0
Geum sp.			P	C	1	0	0	1	0	0	1	1			0	0
Glyceria spp.			P	P	1	1	0	0	0	0	1	1			0	0
Impatiens capensis	spotted touch-me-not	FACW	P	P	1	1	0	0	0	0	1	1			0	0
Ipomea sp.			P	P	1	1	0	0	0	0	1	1			0	0
Juglan cinerea	butternut	FACU	P	P	1	1	0	0	0	0	1	1			0	0
Juncus canadensis	Canada rush	OBL	P	C	1	0	0	1	0	0	1	1			0	0

Juncus dudleyi	Dudley's rush	NL	P	P	1	1	0	0	0	0	1	1			0	0
Juncus effusus	soft rush	FACW	C	P	0	1	1	0	0	0	**1**	**1**	1	1	0	0
Juncus torreyi	Torrey's rush	FACW	P	P	1	1	0	0	0	0	1	1			0	0
Leersia oryzoides	rice-cut grass	OBL	C	C	0	0	1	1	0	0	1	1			0	0
Lemna minor	lesser duckweed	OBL	A	A	0	0	0	0	1	1	1	1			0	0
Lespedeza intermedia	wandlike bush cover	NL	-	P	0	1	0	0	0	0	0	1			0	1
Leucospora multifida	narrow leaf paleseed	OBL	P	-	1	0	0	0	0	0	1	0			1	0
Lobelia siphilitica	great lobelia	FACW	-	-	0	0	0	0	0	0	0	0			0	0
Lycopus americanus	American bugleweed	OBL	C	C	0	0	1	1	0	0	1	1			0	0
Lysimachia sp.			-	P	0	1	0	0	0	0	0	1			0	1
Mentha arvensis	field mint	FACW	P	P	1	1	0	0	0	0	1	1			0	0
Mimulus ringens	Allegheny monkey flower	OBL	P	P	1	1	0	0	0	0	1	1			0	0
Oenothera biennis	evening primrose	FACU	P	P	1	1	0	0	0	0	1	1			0	0
Oxalis sp.	yellow wood sorrel	NL	P	C	1	0	0	1	0	0	1	1			0	0
Panicum capillare	witchgrass	FAC	C	C	0	0	1	1	0	0	1	1			0	0
Panicum virgatum	switchgrass	FAC	C	C	0	0	1	1	0	0	1	1			0	0
Pastinaca sativa	wild parsnip	NL	P	P	1	1	0	0	0	0	1	1			0	0
Penthorum sedoides	ditch stonecrop	OBL	C	P	0	1	1	0	0	0	1	1			0	0
Phalaris arundinacea	reed canary grass	FACW	P	P	1	1	0	0	0	0	1	1			0	0
Phaseolus polystachios	wild bean	NL	P	P	1	1	0	0	0	0	1	1			0	0
Phragmites			-	P	0	1	0	0	0	0	0	1			0	1
Plantago major			P	P	1	1	0	0	0	0	1	1			0	0
Plantago lanceolata			P	P	1	1	0	0	0	0	1	1			0	0
Platanus occidentalis			P	P	1	1	0	0	0	0	1	1			0	0
Polygonum hydropiperoides	mild water pepper	OBL	P	C	1	0	0	1	0	0	1	1			0	0
Polygonum lapathifolium	nodding smartweed	FACW	P	P	1	1	0	0	0	0	1	1			0	0
Polygonum pensylvanicum	pink knotweed	FACW	P	P	1	1	0	0	0	0	1	1			0	0
Polygonum persicaria	lady's thumb	FACW	P	C	1	0	0	1	0	0	1	1			0	0
Populus deltoides	eastern cottonwood	FAC	A	A	0	0	0	0	1	1	1	1			0	0
Populus tremaloides	quaking aspen	FACU	P	P	1	1	0	0	0	0	1	1			0	0
Potamogeton foliosus	bushy pondweed	OBL	P	P	1	1	0	0	0	0	1	1			0	0
Potamogeton natans	floating leaf pondweed	OBL	P	C	1	0	0	1	0	0	1	1			0	0
Prunella vulgaris	heal all	FACU	P	P	1	1	0	0	0	0	1	1			0	0
Rhus radican	poison ivy	NL	C	C	0	0	1	1	0	0	1	1			0	0
Rorippa palustris	marsh yellow cress	OBL	P	P	1	1	0	0	0	0	1	1			0	0
Rorippa sylvestris	creeping yellow cress	FACW	P	P	1	1	0	0	0	0	1	1			0	0
Rumex crispus	curly dock	FACU	P	P	1	1	0	0	0	0	1	1			0	0
Sagittaria latifolia	arrowhead	OBL	C	-	0	0	1	0	0	0	**1**	**0**	1	0	1	0
Salix alba	white willow	FACW	C	A	0	0	1	0	0	1	1	1			0	0
Salix eriocephala	Missouri River willow	FACW	C	C	0	0	1	1	0	0	1	1			0	0
Salix exigua (interior)	sandbar willow	OBL	P	C	1	0	0	1	0	0	1	1			0	0
Salix babylonica var.tartarica	weeping willow	FACW	P	P	1	1	0	0	0	0	1	1			0	0
Salix nigra	black willow	FACW	C	A	0	0	1	0	0	1	1	1			0	0
Samolus parviflorus	water pimpernel	OBL	C	C	0	0	1	1	0	0	1	1			0	0
Saururus cernuus	lizard's tail	OBL	P	-	1	0	0	0	0	0	**1**	**0**	1	0	1	0
Schoenoplectus	**tab** soft-stem bulrush	OBL	A	A	0	0	0	0	1	1	**1**	**1**	1	1	0	0
Scirpus cyperinus	wool grass	FACW	-	P	0	1	0	0	0	0	0	1			0	1
Scirpus fluviatilis	river bulrush	OBL	C	-	0	0	1	0	0	0	**1**	**0**	1	0	1	0
Setaria viridis	fox tail grass	NL	C	C	0	0	1	1	0	0	1	1			0	0

Appendix B. Detail of transect vegetation survey for 1999. Survey completed in three zones (Zone 0, Zone 1 and Zone 2) in each transect on both a global and a square meter basis, using the Braun-Blanquet (bb) and US Army Corps of Engineers (ACOE) cover. Transect locations are in Bouchard et al. (1998) and Bouchard and Mitsch (1999).

Vegetation	Zone 0				Zone 1				Zone 2			
	Global		Square meter		Global		Square meter		Global		Square meter	
	bb	ACOE	bb	ACOE	bb	ACOE	bb	ACOE	bb	ACOE	bb	ACOE
Transect 1-1a												
Acer negundo									+	1		
Alisma plantago-aquatica					+	1						
Aster sp					1	1			+	1		
Bidens sp					+	1	1	1				
Carex vulpinoidea									+	1		
Juncus sp					2	2	3	3				
Lemna minor	1	1	1	1								
Polygonium hydropiperoides					+	1						
Populus deltoides					+	1			2	2	2	2
Salix sp	+	1			2	2	1	1	1	1		
Schoenoplectus tabernaemontani	2	2										
Scripus pendulus									1	1	1	1
Penthorum sedoides					+	1			1	1		
Solidago sp					+	1			2	2		
Sparganium eurycarpum	4	4	5	5	1	1						
Spartina pectinata	1	1			3	3			3	3	3	3
Trifolium sp									1	1	1	1
Typha sp	2	2	1	1	+	1						
Transect 1-1b												
Acer negundo					+	1						
Agrostis tenuis									1	1		
Alisma plantago-aquatica												
Aster sp					+	1	1	1	+	1		
Bidens sp					+	1			1	1	1	1
Carex tribuloides									1	1	1	1
Juncus sp					+	1			2	2	+	1
Leersia oryzoides									+	1		
Lemna minor	1	1	1	1								
Penthorum sedoides					+	1			1	1	+	1
Polygonium hydropiperoides					+	1	+	1				
Populus deltoides					+	1			3	3	3	3
Rhus radican					+	1						
Salix eriocephala					1	1						
Salix nigra					+	1			2	2	2	2
Schoenoplectus tabernaemontani	+	1			+	1						
Scripus fluviatilis					+	1						
Solidago sp					+	1	+	1	2	2	+	1
Sparganium eurycarpum	5	5	5	6	2	2						
Spartina pectinata					4	4	4	4	3	3		
Typha sp	+	1	+	1	+	1						
Transect 1-2												
Acer negundo					+	1	1	1	+	1		
Apocynum cannabnum									+	1	1	1
Aster sp					1	1						
Bidens sp					1	1	+	1				
Carex vulpinoidea									+	1	1	1
Daucus carota									+	1		
Epilobium coloratum									1	1		
Juncus sp					2	2	2	2	1	1		
Lemna minor	1	1										
Penthorum sedoides									2	2	1	1
Polygonium hydropiperoides					1	1	1	1				

Solanum carolinense	horse nettle	FACU	P	P	1	1	0	0	0	0	1	1			0	0
Solidago altissima	tall goldenrod	FACU	A	A	0	0	0	0	1	1	1	1			0	0
Sonchus oleraceus	common sow thistle	UPL	P	P	1	1	0	0	0	0	1	1			0	0
Sorghum halepense	johnson grass	FACU	P	P	1	1	0	0	0	0	1	1			0	0
Sparganium eurycarpum	burreed	OBL	A	-	0	0	0	0	1	0	**1**	**0**	1	0	1	0
Spartina pectinata	prairie cordgrass	OBL	C	-	0	0	1	0	0	0	**1**	**0**	1	0	1	0
Taraxacum officinale	common dandelion	FACU	P	P	1	1	0	0	0	0	1	1			0	0
Trifolium dubium	least hop clover	UPL	P	P	1	1	0	0	0	0	1	1			0	0
Trifolium hybridum	alsike clover	FACU	A	A	0	0	0	0	1	1	1	1			0	0
Trifolium pratens	red clover	FACU	A	A	0	0	0	0	1	1	1	1			0	0
Typha angustifolia	narrow-leaved cattail	OBL	A	A	0	0	0	0	1	1	1	1			0	0
Typha latifolia	wide-leaved cattail	OBL	A	A	0	0	0	0	1	1	1	1			0	0
Ulmus pumila	Chinese elm	NL	P	P	1	1	0	0	0	0	1	1			0	0
Ulmus porecea	English elm	NL	P	P	1	1	0	0	0	0	1	1			0	0
Verbena hastata	blue vervain	FACW	P	P	1	1	0	0	0	0	1	1			0	0
Verbena urticifolia	white vervain	FACU	-	P	0	1	0	0	0	0	0	1			0	1
Vitis vulpina	wild grape	FAC	P	P	1	1	0	0	0	0	1	1			0	0
Xanthium strumarium	cocklebur	FAC	P	P	1	1	0	0	0	0	1	1			0	0
	TOTAL				68	62	20	22	10	12	98	96	8	2	9	7

Key : P - PRESENT
C - COMMON
A - ABUNDANT

OBL = obligate wetland species (occurs 99% in wetlands)
FACW = facultative wetland species (occurs 67-99% in wetlands)
FAC = facultative species (occurs 34-66% in wetlands)
FACU = facultative upland species (67-99% in uplands)
UPL = obligate upland species (>99% in nonwetlands)
NI = no indicator (insufficient information)
NL = not listed on the National List (Region 1)

Vegetation	Zone 0 Global		Square meter		Zone 1 Global		Square meter		Zone 2 Global		Square meter	
	bb	ACOE	bb	ACOE	bb	ACOE	bb	ACOE	bb	ACOE	bb	ACOE
Populus deltoides					+	1			2	2	1	1
Salix sp					1	1	1	1	1	1		
Schoenoplectus tabernaemontani	2	2										
Scripus fluviatilis												
Solidago sp									2	2	2	2
Sparganium eurycarpum	3	3	4	4	3	3	2	2				
Spartina pectinata	1	1			1	1	1	1	3	3	4	4
Trifolium sp									1	1	2	2
Typha sp	2	2	2	2								
Transect 1-3												
Acer negundo									+	1		
Aster sp									1	1	1	1
Bidens sp					1	1	1	1				
Carex vulpinoidea					+	1			1	1	+	1
Epilobium coloratum					+	1	+	1	2	2	1	1
Juncus sp	+	1	+	1								
Lemna minor	+	1										
Lycopus virginicus					+	1			1	1	1	1
Penthorum sedoides									2	2	1	1
Polygonium hydropiperoides	+	1							+	1		
Populus deltoides					+	1	+	1	3	3	2	2
Salix sp	+	1			1	1	1	1	3	3	2	2
Schoenoplectus tabernaemontani	2	2										
Solidago sp									1	1	1	1
Sparganium eurycarpum	2	2			+	1						
Spartina pectinata	+	1	+	1	2	2	2	2	1	1		
Trifolium sp					+	1						
Typha sp	2	2	3	3	1	1	+	1	+	1		
Transect 1-4												
Aster sp									2	2		
Cirsium altissimum					1	1	1	1	1	1		
Epilobium coloratum									+	1	+	1
Lemna minor	+	1	+	1								
Lycopus virginicus									1	1	1	1
Populus deltoides									2	2	2	2
Schoenoplectus tabernaemontani	3	3	1	1								
Solidago sp									2	2	2	2
Sparganium eurycarpum	3	3	5	5	5	5	5	5				
Spartina pectinata					1	1	+	1	2	2	2	2
Typha sp	1	1			+	1						
Transect 1-5												
Ascelpias incarnata					+	1	+	1				
Aster sp									+	1	1	1
Carex vulpinoidea									+	1		
Cirsium altissimum					1	1	1	1	1	1	1	1
Daucus carota									+	1		
Epilobium coloratum									1	1	1	1
Juncus sp	1	1							+	1		
Leersia oryzoides					1	1						
Lemna minor	1	1										
Lycopus virginicus									1	1	1	1
Polygonium hydropiperoides					+	1						
Populus deltoides					+	1			3	3	3	3
Schoenoplectus tabernaemontani	1	1	+	1	1	1	+	1				
Scripis fluviatilis	2	2	2	2								

Vegetation	Zone 0 Global bb	Zone 0 Global ACOE	Zone 0 Square meter bb	Zone 0 Square meter ACOE	Zone 1 Global bb	Zone 1 Global ACOE	Zone 1 Square meter bb	Zone 1 Square meter ACOE	Zone 2 Global bb	Zone 2 Global ACOE	Zone 2 Square meter bb	Zone 2 Square meter ACOE
Solidago sp									2	2	2	2
Sparganium eurycarpum	4	4	3	3	5	5	4	4				
Vitis vulpina									+	1		
Transect 1-6												
Acer negundo									1	1		
Alisma plantago-aquatica	1	1										
Bidens sp					1	1						
Carex vulpinoidea									1	1		
Juncus sp	1	1			2	2	1	1	1	1		
Lycopus virginicus									1	1		
Penthorum sedoides									+	1		
Populus deltoides					1	1			2	2	1	1
Salix sp	1	1			1	1			2	2	1	1
Schoenoplectus tabernaemontani	2	2	1	1								
Solidago sp									2	2	2	2
Sparganium eurycarpum	3	3	3	3								
Spartina pectinata					4	4	4	4	3	3		
Taraxacum officinale									1	1	+	1
Trifolium sp									2	2	1	1
Typha sp	2	2	2	2	1	1			1	1		
Transect 1-7												
Bidens sp									1	1	1	1
Carex vulpinoidea									1	1		
Daucus carota									+	1	+	1
Epilobium coloratum									1	1	+	1
Juncus sp					2	2	2	2	1	1		
Lemna minor	1	1	1	1	1	1	+	1				
Penthorum sedoides									1	1		
Polygonium hydropiperoides					1	1	+	1				
Populus deltoides									1	1	1	1
Salix sp					2	2			2	2	1	1
Schoenoplectus tabernaemontani	4	4	3	3	2	2	2	2				
Solidago sp									1	1	1	1
Sparganium eurycarpum					1	1						
Spartina pectinata					3	3			1	1		
Trifolium sp					1	1			1	1		
Typha sp	1	1	2	2	3	3	3	3	+	1		
Transect 1-8												
Acer negundo									+	1		
Bidens sp					1	1	+	1	+	1		
Carex vulpinoidea									1	1		
Epilobium coloratum									1	1		
Juncus sp					1	1						
Leersia oryzoides					1	1						
Lemna minor	1	1	+	1								
Lycopus virginicus									+	1		
Penthorum sedoides									+	1		
Polygonium hydropiperoides					+	1	1	1				
Populus deltoides					1	1	1	1	2	2	2	2
Salix sp					2	2	2	2	3	3	2	2
Schoenoplectus tabernaemontani	1	1	1	1	+	1						
Scripus fluviatilis									+	1		
Solidago sp					+	1			1	1	1	1
Sparganium eurycarpum	2	2	3	3	+	1						
Taraxacum officinale									+	1		

Vegetation	Zone 0 Global bb	Zone 0 Global ACOE	Zone 0 Square meter bb	Zone 0 Square meter ACOE	Zone 1 Global bb	Zone 1 Global ACOE	Zone 1 Square meter bb	Zone 1 Square meter ACOE	Zone 2 Global bb	Zone 2 Global ACOE	Zone 2 Square meter bb	Zone 2 Square meter ACOE
Trifolium sp					1	1	1	1	1	1	1	1
Typha sp	2	2	1	1	3	3			+	1		
Transect 2-1a												
Acer negundo					+	1			1	1		
Aster sp					+	1			+	1	+	1
Bidens sp					1	1			1	1	+	1
Carex vulpinoidea									1	1	+	1
Cirsium altissimum									+	1	+	1
Daucus carota									1	1	1	1
Epilobium coloratum					1	1	1	1	1	1	1	1
Juncus sp									+	1	1	1
Leersia oryzoides					1	1	+	1				
Lemna minor	1	1	1	1								
Lycopus virginicus					+	1	+	1				
Polygonium hydropiperoides					1	1	2	2				
Populus deltoides					1	1			1	1	+	1
Salix sp					2	2	+	1				
Schoenoplectus tabernaemontani	1	1	1	1	1	1	2	2				
Solidago sp					+	1			3	3	3	3
Trifolium sp									1	1		
Typha sp	3	3	5	5	2	2	2	2				
Transect 2-1b												
Aster sp					1	1	1	1	1	1	1	1
Bidens sp					+	1			+	1	1	1
Carex vulpinoidea									1	1	+	1
Cirsium altissimum									+	1		
Daucus carota									+	1		
Epilobium coloratum									1	1	1	1
Leersia oryzoides	+	1										
Lemna minor	1	1	1	1								
Lycopus virginicus									1	1		
Panicum virgatum					+	1	1	1				
Polygonium hydropiperoides					1	1	+	1				
Populus deltoides					+	1			2	2	1	1
Salix sp					2	2	+	1	2	2	2	2
Schoenoplectus tabernaemontani	1	1	1	1								
Scripus fluviatilis									2	2	1	1
Trifolium sp									1	1		
Typha sp	4	4	4	4	3	3	3	3	+	1		
Transect 2-2												
Acer negundo									1	1		
Aster sp					1	1			1	1	1	1
Bidens sp	+	1			+	1						
Carex vulpinoidea									1	1	1	1
Daucus carota									2	2	1	1
Epilobium coloratum					1	1	1	1	1	1	1	1
Lemna minor	1	1	1	1								
Lycopus virginicus	+	1			1	1	1	1	1	1		
Panicum virgatum					1	1						
Populus deltoides					1	1	1	1	3	3		
Salix sp					3	3	3	3	1	1		
Schoenoplectus tabernaemontani	3	3	2	2								
Solidago sp									2	2	+	1
Trifolium sp									+	1		
Typha sp	3	3	2	2	2	2	+	1				

Vegetation	Zone 0 Global bb	Zone 0 Global ACOE	Zone 0 Square meter bb	Zone 0 Square meter ACOE	Zone 1 Global bb	Zone 1 Global ACOE	Zone 1 Square meter bb	Zone 1 Square meter ACOE	Zone 2 Global bb	Zone 2 Global ACOE	Zone 2 Square meter bb	Zone 2 Square meter ACOE
Transect 2-3												
Acer negundo					+	1						
Aster sp					+	1	+	1	1	1	2	2
Bidens sp					+	1	1	1				
Carex vulpinoidea									+	1	+	1
Daucus carota									1	1	1	1
Epilobium coloratum					1	1	1	1	1	1	1	1
Lemna minor	1	1	1	1								
Lycopus virginicus					1	1						
Populus deltoides					2	2	1	1	1	1		
Salix sp					2	2						
Schoenoplectus tabernaemontani	2	2	3	3	1	1						
Solidago sp					1	1	1	1	2	2	1	1
Trifolium sp					1	1	1	1	1	1	1	1
Typha sp	5	5	4	4								
Transect 2-4												
Acer negundo					1	1	1	1	1	1		
Aster sp					1	1	1	1	+	1		
Bidens sp					+	1						
Carex vulpinoidea									1	1	1	1
Cirsium altissimum					+	1			+	1		
Daucus carota									1	1		
Epilobium coloratum					1	1	1	1	+	1	1	1
Juncus sp									1	1		
Lemna minor	1	1	1	1								
Lycopus virginicus					+	1	1	1				
Populus deltoides					1	1	2	2	2	2		
Salix sp					1	1	2	2				
Schoenoplectus tabernaemontani	4	4	3	3	1	1						
Solidago sp									1	1		
Trifolium sp									1	1	1	1
Typha sp	3	3	3	3	+	1						
Vitis vulpina					+	1						
Transect 2-5												
Acer negundo									+	1		
Aster sp					+	1	1	1	+	1		
Bidens sp					+	1						
Carex tribuloides					1	1	+	1	+	1		
Carex vulpinoidea					+	1			+	1	+	1
Daucus carota					+	1			1	1	1	1
Epilobium coloratum					1	1	1	1	1	1	1	1
Juncus sp									1	1		
Lemna minor	1	1	+	1								
Lycopus virginicus					1	1	1	1	+	1		
Polygonium hydropiperoides					+	1						
Populus deltoides					1	1	2	2	+	1		
Salix sp					2	2	2	2	1	1		
Schoenoplectus tabernaemontani	5	5	5	5	3	3						
Solidago sp									1	1	1	1
Trifolium sp									1	1	1	1
Typha sp	1	1	+	1	2	2						
Transect 2-6												
Acer negundo									+	1		
Agrostis tenuis									1	1		
Aster sp					1	1			1	1	1	1

Vegetation	Zone 0				Zone 1				Zone 2			
	Global		Square meter		Global		Square meter		Global		Square meter	
	bb	ACOE	bb	ACOE	bb	ACOE	bb	ACOE	bb	ACOE	bb	ACOE
Bidens sp					1	1	+	1	+	1	1	1
Daucus carota									1	1	1	1
Epilobium coloratum									1	1		
Lemna minor	+	1										
Lycopus virginicus					+	1			+	1		
Penthorum sedoides									1	1		
Polygonium hydropiperoides					+	1						
Populus deltoides					1	1			2	2	2	2
Salix sp					2	2			2	2	1	1
Schoenoplectus tabernaemontani	3	3	2	2	2	2	2	2				
Solidago sp									2	2	2	2
Spartina pectinata					1	1			1	1		
Taraxacum officinale									+	1		
Trifolium sp									1	1	+	1
Typha sp	3	3	3	3	2	2	2	2	+	1		
Vitis vulpina									+	1		
Transect 2-7												
Acer negundo									+	1		
Aster sp									1	1	+	1
Bidens sp									+	1		
Carex vulpinoidea									1	1		
Epilobium coloratum									1	1		
Juncus sp												
Leersia oryzoides												
Lemna minor	+	1	1	1	+	1						
Lycopus virginicus									1	1	2	2
Polygonium hydropiperoides					+	1	+	1				
Populus deltoides					1	1	+	1	2	2		
Salix sp					3	3	3	3	3	3	3	3
Schoenoplectus tabernaemontani	3	3			2	2	1	1				
Scripus fluviatilis												
Solidago sp									2	2		
Sparganium eurycarpum												
Spartina pectinata					+	1	1	1	1	1	1	1
Trifolium sp					+	1			1	1		
Typha sp	3	3	5	6	2	2	1	1				
Transect 2-8												
Acer negundo					+	1						
Agrostis tenuis					1	1	2	2				
Alisma plantago-aquatico					+	1						
Aster sp					1	1			1	1	1	1
Bidens sp					+	1	1	1				
Carex vulpinoidea									+	1		
Daucus carota									1	1	1	1
Epilobium coloratum					+	1	1	1	1	1	1	1
Lemna minor	+	1	+	1								
Lycopus virginicus					1	1	1	1	+	1		
Polygonium hydropiperoides					+	1						
Populus deltoides					1	1			1	1	1	1
Salix sp					2	2	2	2	2	2	2	2
Schoenoplectus tabernaemontani	1	1	2	2	+	1						
Solidago sp									1	1	1	1
Trifolium sp									1	1	1	1
Typha sp	5	5	5	5	3	3	3	3				